
पॉलीविनाइल क्लोराइड (पी वी सी)
औद्योगिक जूते — विशिष्टि
(दूसरा पुनरीक्षण)

Polyvinylchloride (PVC)
Industrial Boots — Specification
(Second Revision)

ICS 61.060

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भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Leather, Tanning Materials and Allied Products Sectional Committee had been approved by the Chemical Division Council.

Polyvinyl chloride (PVC) boots are meant to protect feet, ankles and knees against rains during monsoon and while working in slushy area. Such boots are also recommended for light duty purpose in tanneries, food and beverage industries, sewage treatment plants, petrochemical, cement and pharmaceuticals industries, garbage disposal in municipal corporations and in building construction work, because polyvinyl chloride has very good resistance to water, alcohols, acids and alkalies. Such boots are having wide ranging operation including horticulture and agriculture in cold bound areas also.

Polyvinyl chloride boots are not to be used in areas which are prone to fire and explosion. Such operations include mining, oil exploration, firefighting etc. PVC melts at 80-90 °C and not fit for use in areas where heat generation and fire hazard is of major concern.

This standard was first published in 1988 and considerable assistance was derived from ISO 4643 : 1980 'Plastic moulded footwear — Polyvinyl chloride industrial boots — Specification', issued by International Organization for Standardization (ISO), Geneva. In the first revision, the standard was harmonized with ISO 4643 : 1980 and this standard is technically equivalent to ISO 4643 : 1980. However, the requirements given in **5.5**, **5.7**, **5.12** and **5.15** were in addition to the requirements prescribed in ISO 4643 : 1980. The requirement under **5.13** was not an obligatory requirement since such tests are generally not required because of the tropical climate of India. PVC industrial boots for women were also included in the scope during first revision. The specified values for sole thickness, volatility, tensile properties, elongation at break for upper material, leg height of boots and hardness were modified and additional requirements for performance and cold flex resistance were introduced in the standard as optional requirements depending on the buyer's need.

In this second revision, effort has been made to align the standard with the latest safety, protective and occupational footwear standard, which are IS 15298 (Part 2), (Part 3) and (Part 4), respectively. In this latest revision, the boots are classified according to design and protection level.

Bibliography is given in Annex C and the composition of Committee responsible for development of this standard is given in Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

POLYVINYLCHLORIDE (PVC)

INDUSTRIAL BOOTS — SPECIFICATION

(*Second Revision*)

1 SCOPE

This standard prescribes requirements, methods of sampling and test for safety, protective and occupational PVC footwear for protection of workers involved in industrial work.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to check the possibility of applying the most recent edition of the standards, listed in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 2050, IS 15298 (Part 2), IS 15298 (Part 3) and IS 15298 (Part 4) and the following shall apply:

3.1 Compact Outsole — Outsole made of polymer having density not less 0.9 g/cm^3 .

3.2 Compact Insole — Insole made of polymer having density not less than 0.9 g/cm^3 and 2 mm minimum thickness. For strobil construction Insole shall be made of woven or non-woven cloth.

3.3 Compact Insocks — Insocks shall be made of rubber/polymer/elastomer compound with fabric as top covering. One pair of detachable in-socks having minimum thickness of 3.0 mm at toe and 4.0 mm at heel with arch support shall be provided with each pair of boots.

3.4 Polyvinyl Chloride (PVC) Compound — Compounded form of PVC resin or blend of PVC with other polymer, such as Nitrile rubber, which is homogenously mixed with help of additives and plasticizers, where content of PVC is predominant.

3.5 Lot — A collection of footwear in a consignment belonging to the same size and pattern or batch of manufacture. In case the batch size is small, footwear of the same size and pattern manufactured during a

period, not exceeding a fortnight, may be grouped together to form a lot.

3.6 Defect — A failure or fault such that the product does not satisfy specified physical or chemical requirement, or performance characteristics. It also includes any irregularity in material, workmanship, or damage due to careless and inadequate packing.

3.7 Defective Footwear — Footwear which has one or more defects with respect to the quality characteristics under consideration.

3.8 Acceptable Quality Level (AQL) — The maximum percentage of defective product in a lot, which for the purpose of sampling of footwear, can be considered as satisfactory process average for a given characteristic.

NOTE — For every sampling plan there is an associated AQL value and this value is given as percent defective items in a lot which, under the plan, will be accepted by the purchaser most of the times.

4 CLASSIFICATION

The boots are classified on the basis of design and protection level (*see* Table 1).

4.1 Design

Table 1 Classification of PVC Industrial Boots on Design
(*Clause 4*)

Type	Design
Type I	Ankle boots [<i>see</i> Design B of IS 15298 (Part 2)]
Type II	Wellington/gum boots [<i>see</i> Design D of IS 15298 (Part 2)]

4.2 Protection Level

- a) *Variety 1* — For use as safety footwear;
- b) *Variety 2* — For use as protective footwear; and
- c) *Variety 3* — For use as occupational footwear.

5 PHYSICAL REQUIREMENTS

5.1 General

The PVC industrial boots shall conform to the physical requirements given in Table 2 and may include additional requirements given in Table 3.

Table 2 Physical Requirements for PVC Industrial Boots
(Clause 5.1)

Requirement		Subclause	Test on Finished Footwear/Material
Design	Size	5.2	X
	Height of upper	5.3	X
Whole footwear	Ergonomic feature	5.4.2	X
	Upper-outsole bond strength	5.4.3	X
	Slip resistance	5.4.4	X
	Leak proofness	5.4.5	X
	Toe caps	5.4.6	
	General	5.4.6.1	X
	Internal length of toecap	5.4.6.2	X
	Corrosion resistance	5.4.6.3	X
	Impact resistance of footwear	5.4.6.4	X
	Compression resistance of footwear	5.4.6.5	X
	Colour	5.4.7	I
Upper	Material and thickness	5.5.1	X
	Tensile strength	5.5.2	X
	Flexing resistance	5.5.3	X
	Hardness	5.5.4	X
Lining material	Material	5.6.1	I
	Tear strength	5.6.2	X
	Abrasion resistance	5.6.3	X
	Adhesion of lining with upper	5.6.4	X
Insole	Material and thickness	5.7.1	O
	Abrasion resistance	5.7.2	O
	Water absorption and desorption	5.7.3	O
Eyelets and Laces	Material	5.8.1	X
	Length and Breaking load	5.8.2	X
Insocks	Material	5.9 & 5.9.1	X
	Abrasion resistance	5.9.2	X
	Water absorption and desorption	5.9.3	X
Closing thread	Breaking load	5.10	O
Outsole	Material and thickness	5.11.1	X
	Sole density	5.11.2	X
	Interlayer bond strength	5.11.3	X
	Tear strength	5.11.4	X
	Abrasion resistance	5.11.5	X
	Hardness	5.11.6	X
	Flexing resistance	5.11.7	X
NOTE — Whenever possible, test pieces shall be taken from finished footwear.			
X	Tests shall be carried out on finished footwear		
O	If it is not possible to obtain large enough test piece from finished footwear, then a sample of the material from which the component has been manufactured may be used and this should be noted in the test report. Manufacturer/supplier shall provide a certificate stating that the material sample is the same which has been used for footwear.		
I	Identification by visual and tactile examination		

Table 3 Additional Requirements for PVC Industrial Boots

(Clause 5.1)

Additional Requirement		Subclause	Test on Finished Footwear/Material
Whole Footwear	Conductive footwear	5.4.8.1	X
	Antistatic footwear	5.4.8.2	X
	Penetration resistance	5.4.8.3	X
	Cut resistance	5.4.8.4	X
Upper	Cold flex resistance	5.5.5	X
Outsole	Resistance to acid and alkali	5.4.8.5	X
	Resistance to fuel oil	5.4.8.6	X
	Cold flex resistance	5.11.8	
X Tests shall be carried out on finished footwear			

5.2 Size

Sizes shall be in the range of 4 to 12 English size, conforming to G/H fittings prescribed in Table 1 of IS 1638 for adult size. For conversion of size from Paris point to English size, conversion table of IS 1638 shall be used.

5.3 Height of Upper

When the height of upper of Type I footwear is measured in accordance with 6.2 of IS 15298 (Part 1), it shall conform to values for design B in Table 4 of IS 15298 (Part 2).

When the height of upper of Type II footwear is measured in accordance with 6.2 of IS 15298 (Part 1), it shall conform to values for design D in Table 4 of IS 15298 (Part 2).

5.4 Properties of Whole Footwear**5.4.1 Construction**

The footwear shall be manufactured through injection/casting/compression process as suitable. Variety 1 and 2 shall have lining.

5.4.2 Ergonomic Feature

The boots shall be considered to satisfy the ergonomic requirements if the questionnaire given in 5.1 of IS 15298 (Part 1), is completed and all answers are positive.

However, if the boots meet the criteria specified in 8.4.1.4 of IS 15298 (Part 1), then question 4.3 of Table 2 of IS 15298 (Part 1) is not applicable.

5.4.3 Upper-Outsole Bond Strength

When the boots are tested according to method given in 5.2 of IS 15298 (Part 1), the bond strength shall not be than 4.0 N/mm, unless there is tearing of the sole, in which case the bond strength shall not be less than 3.0 N/mm.

5.4.4 Slip Resistance

When tested in accordance with 5.11 of IS 15298 (Part 1), the shoes shall conform to 5.3.5.2 or 5.3.5.3 of IS 15298 (Part 2).

5.4.5 Leakproofness

When tested in accordance with 5.7 of IS 15298 (Part 1), there shall be no leakage of air.

5.4.6 Toe Caps**5.4.6.1 General**

Metallic or non-metallic toecaps shall be incorporated in the Variety 1 and Variety 2 footwear in such a manner that they cannot be removed without damaging the footwear.

In addition, the toecaps shall have coverings extending over their edge, from the back edge of the toecap to at least 5 mm beneath it and at least 10 mm in the opposite direction. Scuff resistant coverings for the toe region shall not be less than 1 mm in thickness.

5.4.6.2 Internal length of toecap

When measured in accordance with the method described in 5.3 of IS 15298 (Part 1), the internal toecap length shall fulfil the requirements prescribed in 5.3.2.2 of IS 15298 (Part 2).

5.4.6.3 Corrosion resistance

Metallic toecaps shall not exhibit more than three areas of corrosion, none of which shall measure more than 2 mm in any direction, both before and after testing in accordance with the method given in Annex E of IS 5852 (Part 1).

5.4.6.4 Impact resistance

When Variety 1 footwear is tested in accordance with the method described in 5.4 of IS 15298 (Part 1), at an impact energy of (200 ± 4) J, the clearance under the

toecap at impact shall be in accordance with Table 6 of 5.3.2.3 of IS 15298 (Part 2). In addition, the toecap shall not develop any cracks which go through the material, i.e. light can be seen through the crack.

When Variety 2 footwear is tested in accordance with the method described in 5.4 of IS 15298 (Part 1), at an impact energy of (100 ± 2) J, the clearance under the toecap at impact shall be in accordance with Table 6 of 5.3.2.3 of IS 15298 (Part 3). In addition, the toecap shall not develop any cracks which go through the material, that is, light can be seen through the crack.

5.4.6.5 Compression resistance

When variety 1 footwear is tested in accordance with 5.5 of IS 15298 (Part 1), the clearance under the toecap at a compression load of $15 \text{ kN} \pm 0.1 \text{ kN}$ shall be in accordance with Table 6 of clause 5.3.2.3 of IS 15298 (Part 2).

When variety 2 footwear is tested in accordance with 5.5 of IS 15298 (Part 1), the clearance under the toecap at a compression load of $10 \text{ kN} \pm 0.1 \text{ kN}$ shall be in accordance with Table 6 of clause 5.3.2.3 of IS 15298 (Part 2).

5.4.7 Colour

PVC footwear shall not be of black colour.

NOTE — This is required to stop the use of scraps of PVC, including medical waste.

5.4.8 Additional Requirements

Against indent of purchaser, manufacturer may provide the following additional requirements, which may be required for the working conditions.

5.4.8.1 Conductive footwear

When tested in accordance with 5.10 of IS 15298 (Part 1), after conditioning in a dry atmosphere [see 5.10.3.3 of IS 15298 (Part 1)], the electrical resistance shall not be greater than $100 \text{ k}\Omega$.

5.4.8.2 Antistatic footwear

When tested in accordance with 5.10 of IS 15298 (Part 1), after conditioning:

- in a dry atmosphere, the electrical resistance shall be greater than $100 \text{ k}\Omega$ and less than or equal to $1\,000 \text{ M}\Omega$.
- in a wet atmosphere, the electrical resistance shall be greater than $100 \text{ k}\Omega$ and less than or equal to $1\,000 \text{ M}\Omega$.

5.4.8.3 Penetration resistance

5.4.8.3.1 The footwear having penetration resistance property shall be fitted with metallic or non-metallic

perforation resistant insert conforming to IS 17275 (Part 1) or IS 17275 (Part 2), respectively.

5.4.8.3.2 Determination of penetration force

5.4.8.3.2.1 Metallic anti-penetration insert

When footwear is tested in accordance with 5.8.2 of IS 15298 (Part 1), the force required to penetrate the sole unit shall be not less than 1 100.

5.4.8.3.2.2 Non-metallic anti-penetration insert

When footwear is tested in accordance with 5.8.2 of IS 15298 (Part 1), using a force of at least 1 100 N, the tip of the test nail shall not penetrate through the test piece. In order to achieve a “pass” result, the tip of the test nail shall not protrude from the test piece. This is to be checked by visual, cinematographic or electrical detection.

5.4.8.4 Cut resistance

5.4.8.4.1 Footwear with cut resistance shall have a protective area extending from the feather edge to at least 30 mm above it and from the toecap to the heel end of the footwear. It extends beyond the rear end of the toecap by at least 10 mm.

5.4.8.4.2 There shall be no gap between the toecap and the protective material. The protective material shall be permanently attached to the footwear. If different materials are used for protection against cutting, they shall either be attached to each other or overlap (see Fig. 1).

5.4.8.4.3 When the footwear is tested in accordance with the method described in 6.14 of IS 15298 (Part 1), the cut-resistant index (see EN 388) shall be not less than 2.5.

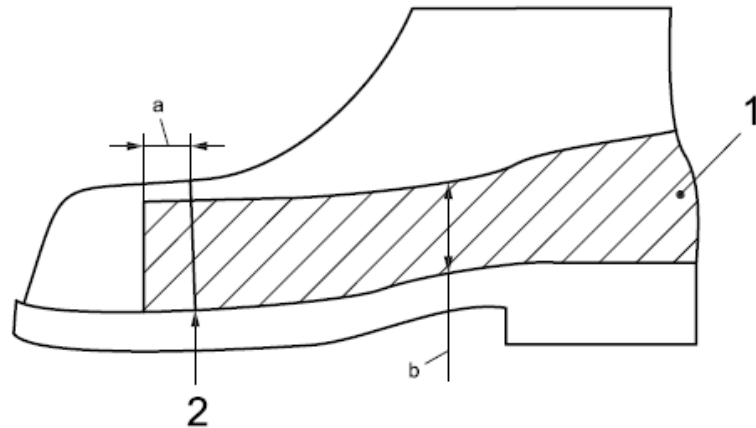
5.4.8.5 Resistance to acid and alkali

The outsole shall conform to requirements prescribed in B-1.3, when tested as per method given in Annex B.

5.4.8.6 Resistance to fuel oil

When tested in accordance with 8.6.1 of IS 15298 (Part 1), the increase in volume of the test sample shall not be greater than 12 percent.

If, after testing in accordance with 8.6.1 of IS 15298 (Part 1), the test piece shrinks by more than 1 percent in volume or increases in hardness by more than 10 Shore A hardness units, a further test piece shall be taken and tested in accordance with the method described in 8.6.2 of IS 15298 (Part 1). The cut growth shall not be greater than 6 mm before 150 000 flex cycles.



Key

- 1 protective area
- 2 rear edge of toecap
- a Overlap of 10 mm over toecap.
- b Minimum height of 30 mm above the feather line.

FIG. 1 COVERAGE OF PROTECTIVE AREA

5.5 Upper

5.5.1 Material and Thickness

Upper shall be of polymeric material duly injected or casted or compressed over a lining material. When determined in accordance with 6.1 of IS 15298 (Part 1), the minimum thickness of the upper for variety 1 and variety 2 shall be 2 mm, and for variety 3 shall be 1.5 mm, measured with lining material. The thickness of the PVC shall not be less than 1 mm.

The minimum thickness of upper at joint region of upper and sole, at the portion where golosh is affixed, shall be 3 mm, and at the back heel side, the minimum thickness shall be 4 mm.

5.5.2 Tensile Strength

When determined in accordance with 6.4 of IS 15298 (Part 1), the tensile properties of the upper shall be as prescribed for polymeric material in Table 13 of IS 15298 (Part 2).

5.5.3 Flexing Resistance

When determined in accordance with 6.5 of IS 15298 (Part 1), the flexing resistance of the upper shall be as prescribed for polymeric material in Table 14 of IS 15298 (Part 2).

5.5.4 Hardness

When determined as per test prescribed in IS 12240 (Part 2), the hardness of the upper shall be 50 ± 5 (Shore A).

5.5.5 Additional-Cold Flex Resistance

If cold flex resistance property of upper is required, the upper shall be tested for cold flex resistance. When parts of the upper are tested in accordance with Annex B of ISO 4643, applied as indicated below, the cold flex temperature shall be not higher than -35°C .

Two test pieces shall be used, cut such that the major axis of one test piece was aligned up the leg of the boot and that of the other across it. A graph shall be prepared showing the relationships between deflection and temperature, and from this the temperature at an angle of 200° deflection of each test piece shall be determined. A deduction of 0.5°C shall be made for each 0.03 mm of the thickness of a test piece above 1.30 mm, and an addition of 0.5°C shall be made for each 0.03 mm of the thickness below 1.27 mm. The arithmetic mean of the two results shall be recorded as the cold flex temperature of the part under test.

5.6 Lining

5.6.1 Material

Coated or non-coated textile lining material (woven or non-woven) shall be used.

5.6.2 Tear Strength

When the lining is tested in accordance with 6.3 of IS 15298 (Part 1), it shall satisfy the requirements prescribed in Table 15 of IS 15298 (Part 2).

5.6.3 Abrasion Resistance

When tested in accordance with 6.12 of IS 15298 (Part 1), the lining shall not develop any holes before 25 600 cycles in dry condition and 12 800 cycles in wet condition.

5.6.4 Adhesion of Lining with Upper

For variety 1 and variety 2 boots, the adhesion of lining with upper shall be tested in accordance with IS 3400 (Part 5). There shall be no separation at a load of 150 N.

5.7 Insole

5.7.1 Material and Thickness

The insole shall be made of woven or non-woven cloth for strobel construction and for compact insole made of polymer having density not less than 0.9g/cm³. Minimum thickness of the insole shall be 2.0 mm when measured in accordance with 7.1 of IS 15298 (Part 1).

NOTE — If the footwear is provided with non-metallic perforation resistant insert, the insert shall be used as the insole.

5.7.2 Abrasion Resistance

When insoles are tested in accordance with 7.3 of IS 15298 (Part 1), the abrasion damage shall not be more severe than that illustrated by the reference test pieces for the same family of materials before 400 cycles [see 7.3.6 of IS 15298 (Part 1)].

5.7.3 Water Absorption and Desorption

When tested in accordance with 7.2 of IS 15298 (Part 1), the water absorption shall be not less than 70 mg/cm² and the water desorption shall be not less than 80 percent of the water absorbed.

5.8 Press Buttons, Eyelets and Laces (Applicable for Type I Boots)

5.8.1 Press buttons, if used may be of different type of metals, such as gun metal/brass/nickle or any other material as agreed between the manufacturer and purchaser.

5.8.2 Eyelets, if used shall be Brass coated steel or aluminium eyelets of size (collar diameter) 10 mm as given in Table 1 of IS 5041. The laces shall be made of nylon or polyester blend and round in shape with a minimum length of 90 cm or as agreed to between purchaser and manufacturer, and with minimum breaking load of 400 N when tested as per the method given in IS 1969 (Part 1) or IS 1969 (Part 2).

5.9 Insocks

One pair of detachable compact insocks having minimum thickness of 3.0 mm at toe and 5.0 mm at heel with arch support shall be provided with each pair of boots.

5.9.1 Material

Insocks shall be made out of rubber/polymer/elastomer compound with drill/twill/suitable textile as top covering.

5.9.2 Abrasion Resistance

When insocks are tested in accordance with 6.12 of IS 15298 (Part 1), the wearing surface shall not develop any holes before the following number of cycles has been performed:

- a) 25 600 cycles when dry; and
- b) 12 800 cycles when wet.

5.9.3 Water Absorption and Desorption

When tested in accordance with 7.2 of IS 15298 (Part 1), the water absorption shall be not less than 70 mg/cm² and the water desorption shall be not less than 80 percent of the water absorbed.

5.10 Closing Thread (If used)

The sewing thread used for upper closing shall be 6 ply nylon with minimum breaking load of 40 N when tested according to the method described in IS 4910 (Part 3).

5.11 Outsole

5.11.1 Material and Thickness

Outsole shall be made of PVC compound by process of injection/casting/compression moulding.

For variety 1 and Variety 2 boots, compact outsole shall be used.

Thickness of out sole heel shall be as under:

- a) Forepart
With cleat: 10 mm (*min*)
Without cleat: 6 mm (*min*)
- b) Heel
With cleat: 15 mm (*min*)
Without cleat: 9 mm (*min*)

5.11.2 Outsole Density

The relative density of the outsole shall not be more than 1.25 when tested in accordance with the method prescribed in IS 12240 (Part 3).

5.11.3 Interlayer Bond Strength

If the sole is made of bi-polymer/polymer and rubber, the bond between the midsole and the outer sole shall not be less than 4.0 N/mm, unless there is tearing of the sole, in which case the bond strength shall not be less than 3.0 N/mm, when tested according to method given in 5.2 of IS 15298 (Part 1).

5.11.4 Tear Strength

When sole from variety 3 boot is tested in accordance with **8.2** of IS 15298 (Part 1), tear strength shall not be less than 5 kN/m.

When sole from Variety 1 and Variety 2 boots is tested in accordance with **8.2** of IS 15298 (Part 1), tear strength shall not be less than 8 kN/m.

5.11.5 Abrasion Resistance

When outsole of variety 1 and variety 2 is tested in accordance with **8.3** of IS 15298 (Part 1), the relative volume loss shall not be greater than 150 mm³. When outsole of variety 3 is tested in accordance with **8.3** of IS 15298 (Part 1), the relative volume loss shall not be greater than 250 mm³.

5.11.6 Sole Hardness

When determined as per test prescribed in IS 12240 (Part 2), the hardness of the outsole for variety 1 and variety 2 shall be 65 ± 5 (Shore A), and for Variety 3, it shall be 60 ± 5 (Shore A).

5.11.7 Flexing Resistance

When soles are tested in accordance with **8.4** of IS 15298 (Part 1), the cut growth shall not be greater than 4 mm before 30 000 flex cycles.

Spontaneous cracks are accepted in the following circumstances:

- a) Only the centre of the tread area shall be assessed for cracking, that is, cracks under the toecap zone shall be ignored.
- b) Superficial cracks up to 0.5 mm deep shall be ignored.
- c) Soles shall be deemed to be satisfactory if cracks are not deeper than 1.5 mm, not longer than 4 mm and not more than five in number.

5.11.8 Additional-Cold Flex Resistance

If cold flex requirement is required, the outsole shall be tested for cold flex resistance. When parts of the soling are tested in accordance with Annex C of ISO 4643 at a temperature of $-5\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, using three test pieces cut parallel to the centreline of the sole, the thickness of the soling compound shall not be less than 50 percent of the test piece thickness and the number of flexing cycles to achieve 6 mm cut growth shall be not less than 150 000 for each test piece when the measurements of cut growth are confined to the outside surface of the test piece.

6 CHEMICAL REQUIREMENTS**6.1 Volatility**

Three test pieces of thickness (2.0 ± 0.1) mm are taken from upper as well as the sole. When these are tested in accordance with IS 12240 (Part 4), the mean loss in

mass shall not exceed 2 percent for either the test pieces taken from upper or the test pieces taken from sole.

6.2 Lead Content

When the footwear is tested in accordance with the method prescribed in IS 12240 (Part 5), the lead content (as Pb) shall not be more than 2 ppm.

6.3 In addition to the volatility and lead requirement, the footwear shall also conform to requirements prescribed in Table 1 of IS 17011.

7 SAMPLING**7.1 Scale of Sampling**

7.1.1 Samples shall be selected and examined from each lot for ascertaining the conformity of the footwear to the requirements of given specification.

7.1.2 For the purpose of formation of lots, footwear shall be considered to be different, if they differ in any of the ways enumerated below:

- a) Method of preparation;
- b) Type and material of components; and
- c) Size, shape and design.

7.1.3 The number of footwear pairs to be selected from any lot shall depend upon the size of the lot and shall be in accordance with Col 1 and 2 of Table 4. Whenever the lot size is more than 20,000 pairs, the quantity above 20,000 pairs shall be treated as another lot and samples shall be drawn as per Col 1 and Col 2 of Table 3, and so on.

7.2 Methods of Selecting Footwear

7.2.1 Footwear to be selected from the lot shall be chosen at random. In order to ensure the randomness of selection a random number table may be used. For guidance to the use of random number table, IS 4905 may be referred.

7.2.2 In the absence of a random number table, the footwear pairs may be selected from the lot in the following manner: Starting from any footwear pair in the lot, the pairs shall be counted as 1, 2, 3, etc, up to r and so on, in one order. Every r th pair thus counted shall be withdrawn to constitute the sample where r is the integral part of N/n (N and n being the lot size and sample size respectively). This procedure may be stopped as soon as the required number of pairs is obtained.

7.2.3 When the footwear pairs in the lot are packed in a number of cases, a suitable number of cases (not less than 30 percent of the total in the lot) shall be first chosen at random. From each of the cases so chosen, an approximately equal number of pairs shall be picked up from its different parts so as to obtain the required number of pairs.

Table 4 Scale of Sampling and Permissible Number of Defectives for Tests on Whole Footwear
(Clause 7.1.3)

No. of Footwear Pairs in the Lot (N) (1)	Sample Size (n) (2)	Permissible No. of Defective Pairs for Major Defects (3)	Permissible No. of Defective Pairs for Minor Defects (4)	Samples Size for Physical and Destructive Tests (m) (5)
up to 50	8	0	0	3
51 to 90	13	0	1	3
91 to 150	20	0	1	3
151 to 280	32	1	2	5
281 to 500	50	1	3	5
501 to 1 200	80	2	5	5
1 201 to 3 200	125	3	7	8
3 201 to 10 000	200	5	10	8
10 001 to 20 000	315	7	14	10

7.2.3.1 For example, if a lot consists of 1 200 pairs of footwear packed in 50 cases, each containing 24 pairs, not less than 15 cases shall be chosen. If it is decided to open 20 cases, then 4 pairs shall be picked up from different parts of each of the 20 cases, so as to give a total of 80 pairs as specified against the lot of 1 200 in Table 4.

7.3 Number of Tests and Criteria for Conformity

7.3.1 Visual and Tactile Examination

The lot shall be first subjected to detailed visual and tactile examination. The defects usually observed on such examination have been broadly divided into two classes, namely, major defects and minor defects. The list of major and minor defects is given below. It is not exhaustive but covers those which are commonly met with during inspection.

7.3.1.1 Major defects commonly observed during visual inspection of finished footwear:

- Difference in shape, design and colour;
- Incorrect size/wrong size packing/odd pairing;
- Distortion of shape;
- Faulty joining and adhesion of sole, insole and upper;
- Insole cut short;
- Excessive pitting or air pocket or bulging of the sole or any other component;
- The toe reinforcement omitted or not cemented properly to the vamp;
- Crooked imitation stitches and broken stitches; and
- Substandard lace.

7.3.1.2 Minor defects commonly observed during visual inspection of finished footwear:

- Stains and dirt in lining and insole/insocks;
- Illegible marking on the insole/insocks; and
- Slight variation in height of quarter and leg.

7.3.1.3 Inspection for Major Defects

The sample size for this examination is given in col 2 of Table 4. All the selected footwear pairs shall be examined for major defects. Defective footwear under this clause shall be one which contains one or more of major defects and it may or may not show minor defects. A pair is termed defective if one or both of the constituent footwear are defective. The number of defective footwear pairs shall not exceed the permissible number given in col 3 of Table 4 if the lot is to be accepted.

7.3.1.4 Inspection of minor defects

The lot which passes the test under **7.3.1.3** shall be subjected to scrutiny for minor defects. The sample size is the same as in **7.3.1.3**. These sample pairs may be drawn from among those found satisfactory under **7.3.1.3** along with the required number of fresh pairs to give the prescribed sample size. Under this clause defective footwear may contain one or more of minor defects but shall not show any major defect. A pair is termed defective if one or both of the constituent footwear are defective. The number of defective pairs found on this examination shall not exceed the permissible number given in col 4 of Table 4.

7.3.1.5 The lot shall be declared to conform to the requirements for visual and tactile characteristics if 7.3.1.3 and 7.3.1.4 are satisfied. If however, the

number of defective pairs exceeds the permissible number, the lot shall be deemed as not conforming to the requirements for these characteristics.

7.3.1.6 In case of those lots which have been found unsatisfactory for visual and tactile characteristics, all footwear pairs in the lot may be inspected and defective ones replaced. In case of those lots which have been found satisfactory for visual and tactile characteristics, all defective pairs shall be replaced.

7.3.2 Dimensional Characteristics

The lot which has been found satisfactory as in **7.3.1** shall next be tested for dimensional characteristics (**5.2** and **5.3**) without opening up of the footwear. The sample size for this examination is given in col 2 of Table 4. These pairs shall be taken at random and tested for dimensional characteristics. If the number of pairs failing to satisfy the requirements for these characteristics is less than or equal to the corresponding number given in col 3 of Table 4, the lot shall be declared to have met the requirements for these characteristics, otherwise not.

7.3.3 Physical and Destructive Tests

7.3.3.1 Tests for physical requirements

The lot found satisfactory for dimensional characteristics (*see 7.3.2*) shall be next tested for physical characteristics given in Table 1. If the manufacturer claims the footwear to have additional characteristics as given in Table 2, the lot shall be tested for these characteristics as well.

For this purpose the pairs shall be selected at random from the samples which have been tested and found satisfactory for **7.3.2**. The no. of pairs to be selected is prescribed in col 5 of Table 3. These pairs shall be opened up and subjected to required physical tests. The lot shall be declared as satisfactory with respect to these characteristics if all the sample pairs pass the prescribed tests.

7.3.3.2 Tests for chemical requirements

The lot which has been found satisfactory as per **7.3.3.1** shall be finally tested for chemical properties of the components by opening up of the footwear. For this purpose, two pairs shall be drawn at random from those already tested and found satisfactory for **7.3.2**. These two pairs shall then be opened up and tested for chemical requirements of the components as specified in **6**. For chemical analysis, the test samples may be prepared by mixing the cuttings from both the units in a pair. The lot shall be declared to have satisfied the requirements for these characteristics if both the sample pairs are found satisfactory.

7.3.3.3 Sometimes it is not possible to carry out tests by taking component from the finished footwear. In those cases, the component sample has to be collected from the manufacturer/supplier. Table 1 gives a list of requirements to be tested and on which part the tests are to be carried out.

7.3.3.4 For tests to be carried out on material sample (designated by O in Table 1), following sampling plan is to be followed:

- a) Insole material: 3 pieces of minimum size 15 cm × 15 cm; and
- b) Closing thread (5 m).

7.4 The lot shall be deemed as conforming to the standard if it satisfies the requirements of the visual, tactile, dimensional, physical and chemical characteristics prescribed in this standard.

8 MARKING

8.1 Each boot shall be permanently marked with the following:

- a) Size,
- b) Manufacturer's name and brand,
- c) Year and month of manufacture,
- d) Shelf life (1 year from month of manufacture),
- d) Number and year of the standard, based upon which the boots are produced, and
- e) Any other statutory marking.

8.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

9 INFORMATION TO BE SUPPLIED

Each pair of boot shall be supplied with the following information in Hindi and English:

- a) Name and full address of manufacturer;
- b) Details of customer care service provider;
- c) Instruction for storage and maintenance;
- d) Drying procedure for wet boots and proper cleaning of boots;
- e) These boots are not for use in fire hazard/explosion prone areas and in hot contact areas; and
- f) The footwear is not a GREEN footwear and not bio-degradable.

ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

<i>IS No./Other Standard</i>	<i>Title</i>	<i>IS No./Other Standard</i>	<i>Title</i>
1638 : 1969	Sizes and fitting of footwear	12240	Methods of test for polyvinyl chloride boots: Part 2
1969	Textiles — Tensile properties of fabrics: Part 1 Determination of maximum force and elongation at maximum force using the strip method (<i>fourth revision</i>)	(Part 2) : 1988	Determination of durometer hardness Shore A
(Part 1) : 2018		(Part 3) : 1988	Methods of test for polyvinyl chloride boots: Part 3
(Part 2) : 2018	Textiles — Tensile properties of fabrics: Part 2 Determination of maximum force using the grab method (<i>fourth revision</i>)	(Part 4) : 1988	Determination of relative density
2050 : 1991	Glossary of terms relating to footwear	(Part 5) : 1988	Methods of test for polyvinyl chloride boots: Part 4
3400	Methods of test for vulcanized rubber: Part 2 Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)	(Part 6) : 1988	Determination of volatility
(Part 2) : 2014			Methods of test for polyvinyl chloride boots: Part 5
(Part 4) : 2012	Methods of test for vulcanized rubbers: Part 4 Accelerated ageing and heat resistance	15298	Determination of lead content
(Part 5) : 1986	Methods of test for: Part 5 adhesion of rubber to textile fabrics (<i>second revision</i>)	(Part 1) : 2015	Methods of test for polyvinyl chloride boots: Part 6
ISO 4643 : 1992	Moulded plastics footwear — Lined or unlined poly (vinyl chloride) boots for general industrial use — Specification	(Part 2) : 2016	Determination of tensile strength and elongation at break
4910	Tyre yarns, cords and tyre cord warpsheets made from man-made fibres — Methods of test: Part 3 Load and elongation characteristics	(Part 3) : 2011	Personal protective equipment: Part 1 Test methods for footwear (<i>second revision</i>)
(Part 3) : 1989		(Part 4) : 2017	Personal protective equipment: Part 2 Safety footwear
5041 : 1978	Specification for footwear and stationery eyelets (<i>first revision</i>)		Personal protective equipment: Part 3 Protective footwear
5852	Toe caps for protection of feet — Specification: Part 1 Metallic toe caps (<i>fifth revision</i>)	17011 : 2018	Personal protective equipment: Part 4 Occupational footwear (<i>second revision</i>)
(Part 1) : 2019		17274	Chemical requirements for footwear and footwear materials
		(Part 1) : 2019	Perforation resistant inserts for protection of feet — Specification: Part 1 Metallic perforation resistant inserts
		(Part 2) : 2019	Perforation resistant inserts for protection of feet — Specification: Part 2 Non-metallic perforation resistant inserts

ANNEX B

(Clause 5.4.8.6)

METHOD OF TEST FOR RESISTANT TO CHEMICALS

B-1 PROCEDURE

B-1.1 The test pieces cut from the boots shall be tested in accordance with the test methods prescribed in IS 12240 (Part 2) and IS 12240 (Part 6) before and after treatment specified in **B-1.2**. Where it is necessary to use different test pieces, such as for tensile strength test, those tested after the treatment shall be from the same area of the same boot as those tested without being submitted to the treatment.

B-1.2 The test pieces shall then be immersed suitably for a period of 72 ± 2 h at 27 ± 2 °C and 65 ± 5 percent relative humidity in the following reagents which shall be technically pure:

- a) Sulphuric acid – 3.7 kmol of 30 percent, (m/m) (see IS 266);
- b) Hydrochloric acid – 6.0 kmol of 20 percent, (m/m) (see IS 265); and
- c) Sodium hydroxide – 6.1 kmol of 20 percent, (m/m) (see IS 252).

NOTE — Separate test pieces shall be used for each reagent as mentioned above.

B-1.3 After immersion for the specified period, the test pieces shall be tested in accordance with the methods prescribed in IS 12240 (Part 2) and IS 12240 (Part 6). When the results are compared with those from test pieces which have not undergone the treatment:

- a) The decrease in tensile strength shall not exceed 15 percent;
- b) The change in elongation at break shall not exceed 20 percent;
- c) The change in mass of any test piece shall not exceed 2 percent; and
- d) The increase in hardness shall not exceed 10 shore A.

B-1.4 For the footwear to comply with the values prescribed in this standard, the requirements of **B-1.3** (a), (b), (c) and (d) shall be met for each of the three reagents specified in **B-1.2**.

ANNEX C

(Foreword)

BIBLIOGRAPHY

- | | |
|---|---|
| 1 IS 252 : 2013 Caustic soda — Specification
(fourth revision) | 4 IS 4905 : 2015 Random sampling and
randomization procedures (first revision) |
| 2 IS 265 : 1993 Hydrochloric acid (fourth revision) | 5 EN 388 : 2016 Protective gloves against
mechanical risks |
| 3 IS 266 : 1993 Sulphuric acid (third revision) | |

ANNEX D*(Foreword)***COMMITTEE COMPOSITION**

Footwear Sectional Committee, CHD 19

EXPERTS RESPONSIBLE FOR DEVELOPMENT OF STANDARD

<i>Organization</i>	<i>Representative(s)</i>
CSIR-Central Leather Research Institute	DR B. N. DAS (Chairman) DR R. MOHAN (<i>Alternate</i> TO DR B. N. DAS)
Ambuja Cements, Mumbai	SHRI PIYUSH B. JAIN
Arvind Footwear Pvt Ltd, Ahmedabad	SHRI DILIP BORKAR
Mangla Plastics, Bahadurgarh	SHRI J. BASAK
Border Security Force	SHRI PREM VISHWAS
Bureau of Police Research and Development, Delhi	SHRI KRISHNA KANT SINHA
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Directorate General of Quality Assurance, Kanpur	SHRI S. CHAKRABORTY
Directorate General of Factory Advice Service and Labour Institute, Ministry of Labour and Employment	DR BRIJ MOHAN
Footwear Design and Development Institute, Noida	SHRI SHAILENDER SAXENA SHRI NAVENDU SHEKHAR (<i>Alternate I</i>) SHRI BHANU PRATAP SAHNI (<i>Alternate II</i>) SHRI SAROJ KUMAR PANDA (<i>Alternate III</i>)
Footwear (Klick) India Pvt Ltd	SHRI SAURABH GUPTA
MSME Technology Development Centre, Meerut	ADITYA PRAKASH SHARMA
Liberty Shoes Ltd, (P U Division), Karnal	SHRI S. S. LAHIRI
Prolific Engineers	SHRI G. P. KEDIA
XO Footwear, Delhi	SHRI NALIN GUPTA SHRI MANOJ KUMAR (<i>Alternate</i>)
Rapid Action Force, New Delhi	SHRI A. K. SINGH SHRI HARISH CHANDRA (<i>Alternate</i>)
Coast Guard HQ, New Delhi	SHRI BRAJESH PATEL
Defence Institute of Physiology and Allied Sciences, DRDO	DR MADHUSUDAN PAL
Pinza Footwear Pvt Ltd	SHRI PREM MEHANI
BIS Directorate General	SHRI AJAY K. LAL, SCIENTIST 'E' AND HEAD, (CHD) [REPRESENTING DIRECTOR GENERAL (<i>Ex-officio</i>)]

*Member Secretary*MS PREETI PRABHA
SCIENTIST 'C' (CHD), BIS

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002

Telephones: 2323 0131, 2323 3375, 2323 9402

Website: www.bis.gov.in

Regional Offices:

Telephones

Central	: Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	{ 2323 7617 2323 3841
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Northern	: Plot No. 4-A, Sector 27-B, Madhya Marg CHANDIGARH 160019	{ 265 0206 265 0290
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